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Integrating Routine, Variety Seeking and Compensatory Choice in a Utility Maximizing Framework

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by

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Abstract

Given the large number of choices that consumers make each day it seems likely that they will generally adopt decision strategies that minimize cognitive effort, particularly with low price products such as most items found in a supermarket. One such strategy may be to simply choose what has been chosen in the past, i.e. to fall into a pattern of routine choices or decisions. In contrast, there may be preferences for variety in markets for low price, highly differentiated goods. We develop a conceptual and empirical model of routine choice, and the factors that result in transitions to two strategies other than routine selection, to wit, utility maximizing choice among available alternatives and a variety seeking strategy. The empirical approach we employ provides a mechanism for the examination of panel data that avoids the state dependence issues present in most applications to these types of data. We apply this framework to the choice of two food products that illustrate the heterogeneity across types of products in decision strategies and routine choice patterns.

Keywords: Choice modeling, routine behavior, variety-seeking, panel data

JEL Codes: D12, D03, C25

Introduction

Consumers make countless decisions every day. In the area of food choices alone, consumers are estimated to make over 200 choice decisions per day (Wansink and Sobel 2007). Given the sheer number of decisions involved across the many facets of people's lives, it seems unlikely that individuals allocate substantial cognitive effort and time to each and every one of them every time they are faced with one of these myriad decisions. Decisions regarding small budget items like food choices or selections of consumer packaged goods would seem more likely to be relegated to some form of routine (or routinized) choice behavior. Heiner (1983), for example, has suggested that uncertainty prevents fully maximizing behavior, leading instead to the development of what he terms "behavioral rules." Empirically, Hamermesh (2005) examines temporally routine behavior in households (as opposed to routinized choice of products) and finds that the extent of such behavior is partially explained by household characteristics such as income and education.

In terms of product choice in categories involving consumer packaged goods, the consumer behavior literature suggests that individuals transition through a pattern of search among goods until a suitable good is found, and then repeatedly purchase this alternative in a routine fashion; at some point exogenous shocks may lead to a break from routine, with a return to search behavior (Howard and Sheth 1971). Alternate models suggest that consumers make decisions regarding choices from certain categories without conscious consideration of the options (Wansink and Sobel 2007).

If consumers are cognitive misers, it is unlikely that they will always invest significant effort into the evaluation or comparison of alternatives. Thus the use of simplifying decision

strategies (Heiner 1983), e.g. repetition of the last good purchased, seems a likely course for consumer goods which comprise a small part of the budget and are frequently purchased. Over a period of time, then, it seems to us that a record of purchases made by cognitive misers should show patterns of repeated choices.

As a counterpoint to this notion, it may be that if consumers are motivated by a need, or preference, for variety (Hamermesh 2005, Gronau and Hamermesh 2008), the pattern of purchases will be characterized by selections away from a current brand or type. The opposite of repetition, e.g., selection of anything but that chosen last, may therefore appear in choice patterns. Consumers may recognize that the "costs" associated with the choice of a brand or product that they do not enjoy is relatively small, since a different product can be chosen with little impact on the budget or on subsequent satisfaction with consumption. If products are purchased frequently (e.g. yogurt) then the new product will replace the old one in a relatively short period of time. A pattern of wide-ranging choices may thus arise which would correspond to an outcome expected from variety-seeking or search for a new favorite product.

The traditional stochastic full information, utility maximizing model of consumer choice (e.g. McFadden 1981) could generate a number of choice patterns depending on the information facing the consumers and the degree to which product availability, attributes, and prices, as well as promotional activities (advertising, in-store displays, placement in weekly supermarket inserts) vary over time. If attributes, prices and promotional activities are constant over time, then one can expect repetitive choice as a result of individual utility maximization. Alternately, a changing environment and/or learning may generate choices that vary widely over the range of available products.

In this paper we investigate patterns of choices of consumer packaged goods over time, with a focus on understanding the relative role of repetitive, variety seeking and optimizing decision making in explaining observed choices. We begin with a descriptive analysis of choice patterns over a set of goods ranging from snack products and beverages to personal hygiene items. Our descriptive analysis results in two major findings or stylized facts. First, pure repetition of choices (successive choice across purchase occasions of the same SKU or stock-keeping unit) is *not* the norm. In our examination of 25 consumer packaged goods, the average likelihood of repetition is at most 55%. Second, there is a large amount of heterogeneity in the degree of repetition over the set of goods. Some products (e.g. milk, margarine and butter) exhibit substantial repetitive choice (around 50%), while others (e.g. toothbrushes, deodorants, cereals) do not display significant repetition (less than 20%).

These stylized facts regarding choice patterns then lead us to a more detailed examination of conceptual models of choice and empirical scrutiny of two specific consumer goods. We construct a model that separates consumer decision making strategies into three archetypal states: pure variety-seeking, full information evaluation (specifically, utility maximizing, compensatory decision making) and pure habit or routine. We model a form of two-stage decision making: at a higher level, the consumer determines how to make a decision, then conditional on the strategy, which product to purchase. In the first stage consumers decide whether to make a routine choice, engage in evaluation of alternatives, or make a pure variety seeking choice. The choice among strategies is modeled as a form of utility maximization that depends in part on the expected utilities of the products, but also on potential processing costs and variety seeking premia. The choice of product in the full evaluation mode is

determined by utility maximization.

Our empirical approach avoids the difficulties associated with the use of lagged endogenous variables to model habits or routine choices and allows us to concentrate on the factors underlying participation in these decision states. Furthermore, as discussed below, our approach avoids issues associated with state dependence as preference parameters are stable over time but decision strategies are assumed to change.

Based on our descriptive analysis we expect that different types of consumer packaged goods will generate different mixtures of the alternative strategy states. Furthermore, literature on routine decisions and repetitive choice suggests that demographic characteristics influence the degree of repetition or variety-seeking (Verplanken et al. 2005; Weiss 2010) – an outcome that we also find in our descriptive analysis. Finally, we explore factors that influence transitions from one state to another. In particular, we examine transitions from the pure habit (or choice repetition state) to a full evaluation mode. As expected, changes in the shopping environment (e.g. advertising promotions) lead to state changes away from repetitive choice and towards full evaluation or pure variety-seeking. Other aspects of choice, such as the number of available products (choice set size) and the inter-purchase time, also influence membership in the decision strategy categories.

A number of implications arise from our findings. First, they provide insights for consumer behavior characterization. Most consumer demand analysis is conducted using static, optimizing, full information (i.e. fully evaluative) models. Our empirical analysis incorporates temporal aspects of choice but uses a decision strategy framework in which consumers can choose to simply repeat the previous type purchased in order to minimize cognitive effort

(repetition), to randomly choose another product than the one chosen last (pure variety-seeking, but which also minimizes effort), or to conduct a comprehensive re-assessment of all products based on attributes and prices (full evaluation). Thus, the joint selection of strategy and product frames the overarching utility maximization problem. We find that, depending on the product type, repetition and variety-seeking are important components to explain the demand for individual products. Furthermore, the degree of repetition is affected by demographic factors as well as choice environment conditions and market structure. We find that changes in the shopping environment (viz., in-store promotions and displays, weekly newspaper inserts) generate increases in the use of the full evaluation and variety seeking decision strategies.

Finally, we show that the proposed approach of modeling potentially routine decisions as arising from a selection of decision strategy, followed then by product choice conditional on this strategy, provides a strong alternative explanation to habit formation based on the phenomenon of state dependence (Heckman 1981). In the literature, state dependence implies that current product utility is impacted by prior choices, leading to an association of additional utility with previously experienced products. In a sense, this is justified from the perspective that consumers learn what they like through experience, and this affects their current behavior over and above the utility generated from product attributes and marketing activity. State dependence implies, therefore, that product utilities evolve over time based on past choice behavior in a way unique to each purchaser, even with the maintained hypothesis of constant tastes for attributes and price. The proposed approach to modeling routine decisions laid out in this paper is shown empirically to perform much better in two product categories than

corresponding models involving lagged choice variables in the utility function, which is a common form of representing state dependence effects. This suggests to us that utility function based state dependence representations should be re-examined for use in the types of product categories we study here. State dependence approaches may be better process representations in durables than in categories that are routinely and frequently purchased.

The remainder of the paper continues as follows. First we provide a description of repetitive choice behavior over a range of consumer packaged goods. These findings illustrate the heterogeneity in repetitive choice behavior over goods. We then develop the conceptual framework in which choice is influenced by attributes and prices as well as decisions states characterized as evaluative, habitual/repetitive and variety-seeking. We outline the factors affecting the selection of decisions states. In the fourth section of the paper we report the results of our detailed empirical analysis of product choice and decision states. We conclude with a discussion of the implications of our findings.

Stylized Facts on Repetitive Choice in Consumer Packaged Goods

We begin our investigation by examining the degree to which consumers repeat immediately prior choice decisions at the SKU (stock-keeping unit) level. We use scanner panel data for the United States sourced from Information Resources, Inc., to examine purchases over time. These data are described in Bronnenberg et al. (2008).[i] We employ five years of data corresponding to the period January 1, 2001 through December 25, 2005.

Figure 1 presents the average percent of repeated choices between two sequential purchase occasions, over a large number of households and a wide range of consumer packaged goods. Clearly there is significant variation in the degree of repetition over these

goods. For some goods repetition is relatively high, with approximately half of the purchase occasions involving repeat SKU selection. Surprisingly perhaps, for many other products that one might *a priori* believe would have high incidence of "routine selections," there is relatively little repetition on average. Personal care products, for example, reflect relatively little repetition, as do cereals and mustards and catsups.

--- Figure 1 about here ---

This heterogeneity in repetitive SKU purchase raises questions about the possible causes associated with this behavior. Or to turn the issue around, what gives rise to the need for more rational and cognitively intensive decision making in certain of these product categories? Economics has suggested that rule development is an optimal response to choice environment complexity (e.g. Heiner 1983, Hamermesh 2005). On the other hand, the consumer behavior literature has suggested that repeated consumption of the same product can lead to feelings of monotony, boredom and satiation (Menon and Kahn 1995). Gronau and Hamermesh (2008) outline the potential economic welfare enhancing aspects of variety. The inner desire to maintain an optimal stimulation level (OSL) has been shown in that literature to be a self-generated source for wanting change (McAlister and Pessemier 1982). In addition, exogenous stimuli (e.g. novelty, environmental change and complexity, uncertainty, conflict, advertising, word-of-mouth, group affiliations – Howard and Sheth 1969, McAlister and Pessemier 1982) also contribute to the consumer's desire to not repeat a past behavior. This desire for change activates some level of variety-seeking behavior, which covers a plethora of decision strategies ranging from the cognitively simple (e.g. random choice of anything except the prior choice) to the cognitively complex (e.g. full information, utility maximizing choice).

Since these data reflect choices at a household level, it is plausible that household characteristics might affect the repeated buying of the same SKU on sequential purchase occasions, as well as the converse. For example, in certain product categories (e.g. those that have a variation in flavors – yogurts, salty snacks, frozen pizzas) the multiplicity of needs within a household might lead to the purchase of varieties of SKUs. The consumer behavior literature (see the informative review in McAlister and Pessemier 1982; also Verplanken et al. 2005) has identified a number of socio-demographics which are associated with repeated buying: e.g., higher income and/or education are often associated with higher need for variety, larger households (particularly with children) also tend to repeat less, buyer age is correlated with greater repetition, television watching can lead to a greater variety in shopping outcomes, and so forth. Accordingly, we conducted an analysis of the repetition decision at the individual household purchase occasion and SKU level, using the same data that gives rise to Figure 1. The binary dependent variable "repetition of SKU purchased on immediately prior shopping occasion" utilized in logistic regressions for each of the 25 product categories was explained as a function of a number of relevant household characteristics: time since last purchase in the category, household income, work arrangement, educational attainment, age of male and female heads of household, household size, and ages of children.

The following conclusions arise from these logistic regression models[ii]: (1) in all categories, significant statistical variation of the propensity to repeat SKU purchases on sequential purchasing occasions was explained by these independent variables; (2) across the categories, there is significant heterogeneity in goodness-of-fit for these models. To be more precise about this second point, note that $\rho^2 = 1 - LL(\hat{\beta}) / LL(0)$, a goodness-of-fit measure

common in the discrete choice literature, varies from a low of 0.02 (for milk) to a high of 0.52 (toothbrushes), where $LL(\hat{\beta})$ is the log likelihood at convergence and $LL(0)$ is the sample log likelihood for random choice. (This figure of merit ranges from zero to unity.) Figure 2 plots ρ^2 against the average rate of SKU repetition from Figure 1. The relationship between these quantities is simply striking: Figure 2 clearly shows that the variation in repeating behavior is explained less by household socio-demographics in the categories in which repeating behavior is highest, and much more so in those with lower repeating behavior. The question which arises is, if not socio-demographics, what then lies behind the *non*-repetitive (i.e. evaluative, variety-seeking) behavior? Clearly, there is room for a significant and varying role for both intrinsic (e.g. need for variety, satiation) and extrinsic (e.g. advertising, promotional activities) stimuli to account for such wide variability in repetitive buying behavior in these product categories.

--- Figure 2 about here ---

These stylized facts raise a number of questions about consumer choice and repetition. Is the degree of repetition a function of the characteristics of the good or of the category of the good? For example, in some categories there may not be many SKUs or brands, *ceteris paribus* making repeat purchase more likely. The degree of repetition may depend on other characteristics of the category – firms may be changing the composition of the category by introducing new SKUs, consumers need for variety may be higher in some product categories than in others, etc. What is the relative importance of intrinsic versus extrinsic stimuli in explaining repetition and variety-seeking? How much more important is the role of marketing activity in inducing changed behavior in categories with high versus low rates of repetition? We attempt to integrate these observations into a coherent modeling framework in the next

section, to address such questions.

Conceptual Model

Most conceptual and empirical models of repetitive behaviors, routine choices or habits employ intertemporal models that include the potential for habits or variety-seeking (e.g. Chintagunta 1993; Swait et al. 2004, Siddhartha et al. 2004; Arnade et al 2008). These models are not usually formulated to explain the choice of routine as a "strategy;" rather, they attempt to incorporate intertemporal utility effects into empirical models of disaggregate choice. An alternative formulation is to specify deviations from routine as being costly (because of increased costs of variety or efficiencies associated with routines) but also potentially allowing for utility arising from variety itself (Hamermesh 2005). This second perspective suggests that variety and routine may provide utility directly, regardless of the choices of products made. It also suggests that a "higher level" of utility maximization is employed in evaluating whether a routine or variety seeking strategy is chosen.

In another strand of the literature there is evidence that consumers (and decision makers in general) employ dual-process mechanisms (Kahneman and Frederick 2002). Type 1 processing is based on simple heuristics or rules influenced by the choice environment and past behavior or choice. Such processing is also typically characterized as rapid and nearly unconscious (Evans 2003). Type 2 processing takes longer and may involve more careful evaluation of objects and outcomes. Purely repetitive behavior (or routine choice) is more closely aligned with Type 1 processing, as are other processes involving little evaluation – e.g., random choice from a subset of goods (i.e. random choice from a choice set), or choosing anything except what was chosen last time (perhaps to satisfy an inherent need for variety).

Type 2 processing, on the other hand, is more likely to be associated with more complex decision modes, such as fully informed optimization over the available goods. The conceptual model we develop below is based on this notion of switching between strategies or decision types.

Consider a consumer who must periodically purchase a consumer packaged good. On a given purchase occasion, the consumer can choose between three archetypal strategies: (a) pure repetition (choosing exactly the same SKU as on the previous purchase occasion), (b) pure variety-seeking (choosing at random anything other than the product SKU previously purchased) or (c) full evaluation (utility maximization from the set of all SKUs available). The first two "strategies" do not involve evaluation of attributes and prices and are simple in terms of cognitive burden. The full evaluation option requires effort but in return yields the utility maximizing choice. In our conceptual framework consumers are assumed to choose between "strategies," then conditional on the outcome of this process, they either make a routine choice, a pure variety-seeking choice, or fully evaluate the set of options to make their final selection. We describe below the strategy selection stage as resulting from a type of utility maximization process, but this process is geared to provide insight about whether the consumer chooses a simple or complex cognitive process to reach his or her purchase decision. This allows us to separate the utility of the process (i.e., routine or variety seeking behavior) from the utility of the good.

Let U_E be the utility associated with the full evaluation of the options available. We assume that consumer n faces a fixed choice set (C_n) of available options, j=1,…,J. In the full evaluation mode the consumer's utility is assumed to take on a random utility form, where U_j is

the overall utility from alternative j, arising from the additive combination of a systematic utility V_j and a random component ε_j, thusly: $U_j = V_j + \varepsilon_j$. The systematic utility contains information on attributes and prices that is observable by the researcher, while ε_j contains other components of utility unavailable to the researcher but known by the consumer. Assuming a Type I extreme value distribution for ε_j generates the conditional logit model (Ben-Akiva and Lerman 1985; McFadden 1981). The expected value of the maximum utility from this set of options can therefore be summarized as $ln \sum_{j \in C_n} e^{V_j}$ (Ben-Akiva and Lerman 1985). This expression, commonly referred to as the "log-sum" or "inclusive value," gives the expected *maximum* utility from the set of options in full evaluation mode. Given that full evaluation likely consumes cognitive resources, we assume that the utility of the full evaluation strategy takes the form

$$U_E\left(ln \sum_{j \in C_n} e^{V_j} - PC\right), \quad (1)$$

where PC represents cognitive processing costs.

The "utility" of pure repetition or routine decision making is assumed to simply generate the utility of the product previously chosen. Arbitrarily labeling this as alternative 1, then the utility associated with repetition is

$$U_R(V_1). \quad (2)$$

Relative to the expression in equation (1), the utility of the routine strategy does not include a processing cost because its use requires low cognitive effort.

An alternative to full evaluation or routine is to seek variety or change. A number of representations could be developed for such behavior. One representation is to reflect the utility of variety as a desire for diversity of product choice within the set of available products.

Higher utility from higher diversity can be modeled using a measure of entropy or a Shannon diversity index to represent diversity and assume that the consumer searches over products over time so as to increase entropy or diversity. Maximizing entropy or diversity is achieved when products have equal shares, or equal chance of being chosen. However, this is a fairly complex and cognitively challenging process requiring memory over product consumption. A simplifying heuristic which can approximate this strategy is to choose randomly from all products except the one consumed in the previous period. This strategy provides a contrast to the routine heuristic by employing history, albeit only a single period, and by producing a diversity of consumption outcomes which satisfies the notion of the search for variety. Essentially this strategy can be characterized by "I'll try something different from my last purchase" which will eventually lead to maximum entropy or diversity. Therefore, we model the utility of pure variety-seeking as the expected utility from the set of options other than the one chosen in the previous period. We assume that this process, which is also a type of simplifying heuristic, is based on choice at random. This is accomplished by assuming that all elements of the choice set C_n have equal utility. This modifies the log-sum expression and yields the following:

$$U_V\left(ln\sum_{j\in C_{n-1}} e^V \;+\; VP\right) = \; U_V(\tau + \; VP) \quad . \tag{3}$$

The notation C_{n-1} indicates the choice set of person n without the option chosen in the previous period (generically, alternative 1). Since the utilities V are assumed to be constant for all alternatives, the log-sum collapses to a constant – which we denote as τ. Finally, we add a variety premium (VP) to reflect the notion that there may be some added utility associated with experiencing variety.

The consumer chooses the decision strategy to employ based on the maximum of {U_E, U_R, U_V}, subject to income and cognitive processing constraints. Conditional on the strategy, the consumer then proceeds to make a product choice using strategy-specific mechanisms. This can be viewed as a decision tree in which U_R and U_V correspond to Type 1 processing strategies (simple, almost reflexive), while U_E is the full information, compensatory, utility maximization strategy (Type 2 processing). Figure 3 depicts how this decision tree can be used to characterize a sequence of household choices. Framed in terms of the probability of strategy selection, and adding error components to each of the strategy options, the probability of making a routine choice is

$$Prob(R) = Prob\big(V_1 + \varepsilon_R \geq max\big\{ ln \textstyle\sum_{j \in C_n} e^{V_j} - PC + \varepsilon_E \, , \tau + VP + \varepsilon_V \big\}\big) \quad . \qquad (4)$$

The probabilities of variety-seeking and evaluation are similarly constructed.

--- Figure 3 about here ---

The choice between strategies has been framed as depending only on the arguments of the systematic utilities (V_j). However, the decision to choose one strategy over another can also depend on external shocks to the choice environment. For example, an advertising signal may affect the variety premium or the Type 2 processing costs, generating a switch from routine choice to evaluation or variety-seeking. Similarly, the amount of time between purchases (inter-purchase time) may increase the attractiveness of a deviation from routine because of an increase in the variety premium.

In the model we have outlined above, we present an alternative explanation to dynamic choices that does not use the concept of state dependence as a direct modifier of current product utility. Models of dynamic choice have long espoused that decisions of the type being

examined here can exhibit what is termed state dependence (Heckman 1981), wherein current utility for an alternative is dependent upon past choices. While many forms of representing this phenomenon are possible and have been examined in several literatures, in its most basic form the representation of state dependence is accomplished by the inclusion of lagged choices and/or attributes in the utility function (e.g. Heckman 1981; Guadagni and Little 1983; Keane 1997, Lee 1997; Swait et al. 2004). These lagged choices essentially modify current utility by boosting the attractiveness of previously chosen alternatives, in effect creating a repetition premium. In formulations with a single-period lag this premium can be large but somewhat contained by the limited period, but if multi-period lags (e.g. distributed lags, cumulative shares) are used this premium can grow larger and larger, and arguably, eventually insurmountable by other (say, attribute-based) sources of utility after a certain point in the decision sequence. The implicit behavioral mechanism represented by such utility function representations of state dependence, thus defined, is that repetition is the de facto end state of dynamic choices in the type of product categories we examine here. The analysis presented earlier (see Figure 1) militates against such a conclusion.

As shown in Figure 3, at each purchase occasion product utility in the evaluative mode is a function of (temporally stable) tastes with no utility dependence on past behavior. Rather, at each purchase occasion, the buyer decides first on the decision strategy to be employed through an explicit decision cost versus outcome benefit comparison. Past purchase behavior can influence this higher-level decision, but it does not alter the evaluation of the products themselves. In the empirical work that follows, we also present a more traditional model with lagged choice in the utility function, to enable a more substantive evaluation of the two-stage

decision model we propose as current state-of-the-practice with respect to state dependence modeling.

Empirical Investigation

We estimate the proposed model described above for two product categories, catsup and yogurt. The scanner panel data we employ were sourced from AC Nielsen single-source data, corresponding to Springfield, MO. The period covered is from January 1986 to February 1988. The catsup data include 17,504 purchases over 22 SKUs, and yogurt, 3,885 purchases over 67 SKUs.

The statistical implementation of the model described above proceeds by assuming that the error terms associated with the systematic SKU utilities are IID Gumbel (or Extreme Value Type I) with scale μ_E, resulting in a multinomial logit model for the SKU choice within the full evaluation mode. The other two decision modes (pure repetition and pure variety-seeking) do not use utility measures.

The propensity to adopt a given decision strategy is given here by factors that are a function of a constant (of different interpretation depending upon the strategy), interpurchase time T and T^2 (applicable to all strategies), number of SKUs on in-store display (pure variety-seeking) and number of SKUs featured in the weekly supermarket insert (also only for pure variety-seeking). The last two variables are intended to capture intensity of marketing activity in the store environment, and thus are not SKU-specific. (Both variables are available for the catsup category, but only insert information is available for yogurt.) These variables describe the influence of the store environment in triggering the desire to seek variety in consumption. Since the propensity factors are constant at any point in time, only the relative impact of the

independent variables is identifiable. In effect, we employ a polytomous logit model to describe decision strategy selection.

Table 1 presents the maximum likelihood utility function parameter estimates for the full evaluation mode, which are simultaneously estimated with the decision mode selection model. To briefly assess the utility parameter estimates, price sensitivity is negative and significant in both categories, in-store display and presence in the weekly insert increase utility, all effects in the expected directions. In both these categories, larger sizes are penalized by a quadratically increasing amount. Other parameters refer to brand and attribute effects, which are not of specific interest to our research. We also estimate μ_E, the scale of the utilities in the evaluative mode. In both product categories the scale is significantly different from unity.

--- Table 1 about here ---

Turning our attention to the decision strategy propensity functions note that, *ceteris paribus*, pure variety-seeking is more likely than the evaluative mode, relative to pure repetition, in the yogurt category. In the catsup category, however, all else equal, pure repetition is the most likely mode. These statements are based on the estimated propensity function constants. These constants also are indicative, *ceteris paribus*, of the costs and benefits associated with each of decision strategies. For example, all else held equal, in the catsup category the evaluative mode is significantly more "costly" than the repetition mode (estimated PC=-1.4842), while the variety-seeking mode is less costly than the evaluative mode, but more costly than repetition (τ+VP=-0.5547). Thus, in catsup, the activation of full evaluation or variety-seeking is a costly endeavor relative to repetition. Such is not the case in yogurt, where there is a net benefit to full evaluation and variety-seeking relative to repetition. These

results, to a certain degree, provide a test of the hypothesis of significant processing costs that reduce the likelihood of full evaluation – a hypothesis that appears to hold in the case of catsup.

We note also that in the catsup category interpurchase time T has a positive effect on (i.e. makes more likely) the adoption of either the evaluative or pure variety-seeking modes relative to pure repetition. This is as expected. Interestingly, however, T has no discernible effect on selection of decision mode in the yogurt category. This no doubt reflects the fact that interpurchase times for catsup tend to be significantly longer than for yogurt.

With respect to in-store promotional activity, the model for the catsup category discerns a significant impact for the number of SKUs on display, and a very marginal impact for the number of SKUs featured. Both these effects increase the propensity to engage in pure variety-seeking. In the yogurt category, neither effect is significant.

These results on decision mode selection likelihood are more clearly understood from a graphical presentation than through a perusal of the parameters in Table 1. Figures 4 and 5 show the probabilities for the evaluative (E), repetition (R) and variety-seeking (V) decision modes as a function of interpurchase time (T) and whether or not the product is inserted in the weekly supermarket feature publication, respectively for catsup and yogurt. In the catsup product category, the likelihood of the evaluative mode is almost insensitive with respect to interpurchase time, but shows a large increase due to being featured. The variety-seeking and repetition modes are most strongly affected by T, with mode V increasing in T and mode R decreasing in T. This shows that the major tradeoff between the decision modes, at least at the aggregate level we are dealing with here, seems to be between variety-seeking and repetition,

both modes that in our model imply little to no cognitive effort on the part of consumer. Jointly, modes V and R are about as likely as the full evaluation mode E. In the yogurt category, interpurchase time has little effect on decision mode selection, while being featured does impact both the V and E modes; from Table 1 it is seen that these effects are not statistically significant. However, what is significant is that for the yogurt category, the main tradeoff between decision modes is for modes E and V, while mode R remains quite constant over the range. This is quite different from the catsup category.

--- Figures 4 & 5 about here ---

A second set of graphs (Figures 6 and 7, respectively for catsup and yogurt) illustrate the decision mode selection probabilities in a different way. In each graph, these probabilities are shown for a randomly selected household as a function of purchase timing, depicting thus the specific variation of decision mode selection over time. To us, the notable takeaway message is the relatively large variation in decision mode probabilities that the model is capable of capturing as a function of changes in store environment and choice context. In addition, the catsup category graph (Figure 7) shows that the switching between decision modes occurs principally between full evaluation (E) and repetition (R), whereas in the yogurt category (Figure 7) the switching occurs mostly between modes E and V (variety seeking). These results are consistent with the prior insights afforded by Figures 4 and 6.

--- Figures 6 & 7 about here ---

As a comparative model, Table 2 presents multinomial logit (MNL) models for the two product categories; both models include a lagged choice variable in the utility function to capture state dependence (SD) effects. In both categories, this specification yields sensible

results, and depicts a strong SD effect (variable LastSKU). In the catsup category, the price equivalence of the SD effect is on the order of $6.55, and in yogurt, $15.12. Compared to unit prices in these categories, these effects are equivalent to multiple units. These results are typical of estimated effects of SD using this type of specification. Now compare these SD models with the corresponding proposed models in Table 1. Note that in both categories the SD models have much worse goodness-of-fit than the proposed model. This is particularly the case in the catsup category, where the SD model has a log likelihood difference with respect to the proposed model of almost 1,100 units, at the cost of only four additional parameters. In both categories, information criteria (AIC, BIC) will strongly select the proposed model over the SD model. The addition of individual-level parameter heterogeneity will not overcome this kind of difference in performance.

--- Table 2 about here ---

In our view, this last result suggests that the proposed model is a better paramorphic representation of the data generation mechanism for this type of product category than one based on state dependence, as currently understood in the economics and econometric literatures (e.g. Heckman 1981; Keane 1997; Dube et al. 2009). We believe that further research is needed to distinguish contexts in which state dependence is a more suitable approach to capturing choice behavior than is a strategy selection method as employed in our approach. For the consumer packaged goods that we study strategy selection appears to be a better approach; it is possible that for consumer durables a SD approach may be better.

Conclusions

In this paper we examine routine (or repeated) choices. We scrutinize data for 25

consumer packaged goods for evidence of repeated choices of the same stock keeping unit (SKU) and find that the frequency of repeated choice varies significantly over goods, in some cases being very common, while in others proving to be fairly rare. After examination of a set of stylized facts about choices of consumer packaged goods, we construct a conceptual model of consumer choice that includes processing costs (accrued when consumers fully evaluate the set of options available to them) as well as a variety premium. Our conceptual model is a type of two-stage decision making model in which consumers consider the choice of decision strategies as well as product choice. The choice of decision strategy is analogous to a choice by consumers to use Type 1 (nearly subconscious) versus Type 2 (evaluative) decision making. This model is also based on the notion that consumers have limited processing resources or are cognitive misers, and thus there are costs associated with the evaluation of alternatives. On the other hand, the model also allows utility to arise from access to variety.

To evaluate the conceptual model we examine consumer choices from two types of goods – catsups and yogurts. The empirical analysis confirms several notions raised by the motivating set of stylized facts. The parameters of the model illustrate that there are significant processing benefits associated with routinizing choices, particularly in the case of catsup (a commodity with a relatively longer interpurchase period). There also appears to be evidence of a variety premium in the yogurt case, perhaps related to the larger choice set (particularly flavor variations), the more frequent replenishment rate vis-à-vis catsup, and the lower unit prices (implying smaller consequences of misjudgments) for this type of good.

Our empirical approach represents a departure from the typical way of dealing with panel data of the type used in our analysis – to wit, the state dependence approach. This latter

approach, in the context of the models we employ here, is often implemented by the inclusion of a lagged dependent variable in the utility function, and more generally, by the inclusion of some kind of historical consumption record in the utility function. We re-interpret the influence of past consumption, excluding it from the utility function, and instead including it in the decision strategy choice. In our approach, tastes, as reflected in the utility function, are constant over time and utility is stable, in the sense that variations arise only from pricing changes and promotional activities, not from simple cumulative experience with a product. Repeated choice of a product does not affect the utility function, but is determined by selection of the decision strategy. We view this as a major advantage of our empirical framework. Statistically, our approach significantly outperforms a form of the state dependence model.

There are a number of extensions of the framework that we present. First, we have assumed that the size of the choice set is fixed in our analysis. In principle a shock that induces variety seeking or evaluation may result in an expansion of the choice set (i.e. the consideration of a larger set of goods). Alternately, in a single period model (which is very commonly estimated in applied discrete choice analysis) a person in a routine mode may be observationally equivalent to an individual with a choice set of size one. Incorporating choice set formation into our model of decision strategy and choice will provide for a richer examination of consumer behavior.

Second, we examine routine or repeated choices at the level of stock keeping units. It is possible that for some goods routine choice involves a choice from a set of products (a choice set with more than one SKU, as has been implemented in this research), or from a different product aggregation level (e.g. brand). Furthermore, it is possible that there is heterogeneity

across consumers in terms of decision strategy and that this heterogeneity may be observed or unobserved. We view these as desirable extensions of the empirical analysis we present here. Finally, the proposed model can be extended to include parameter heterogeneity in both decision strategy selection and utility evaluation.

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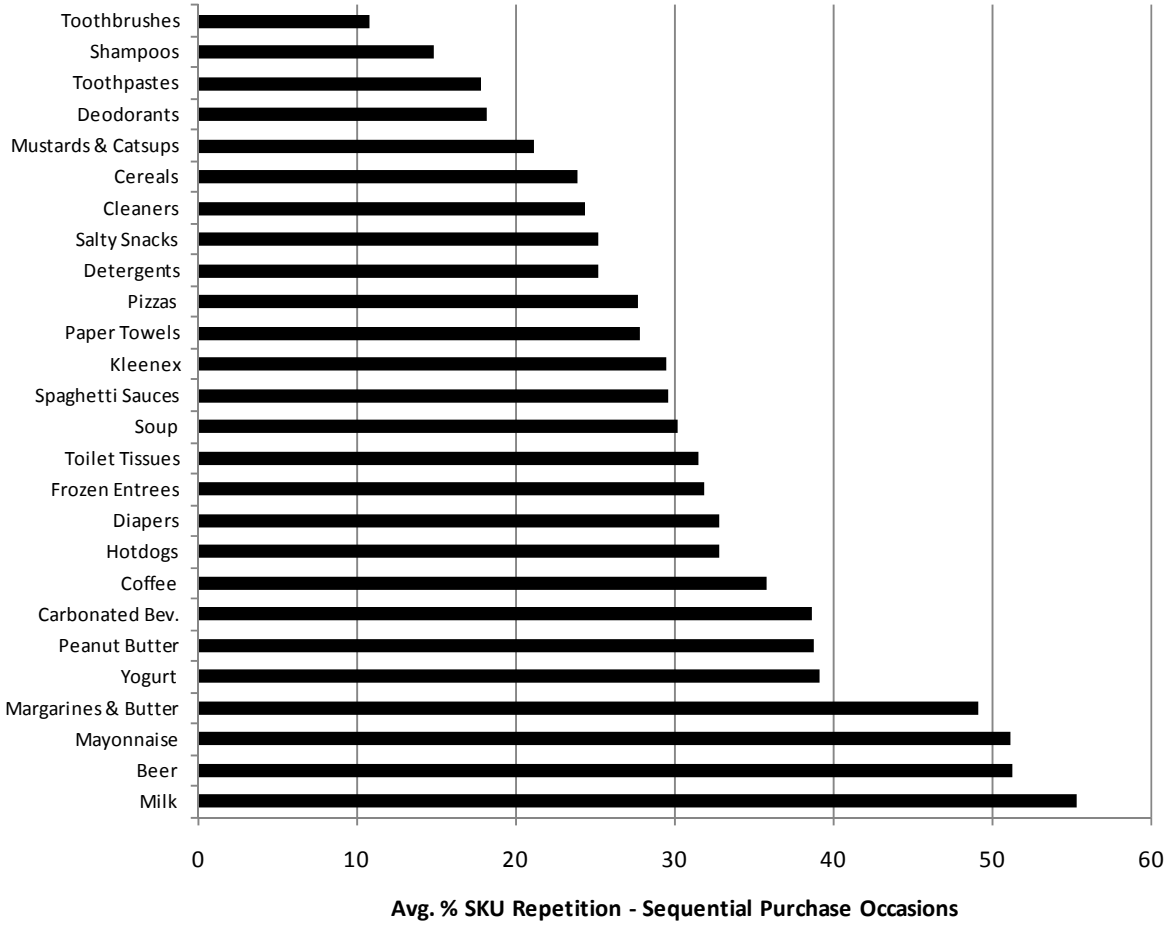
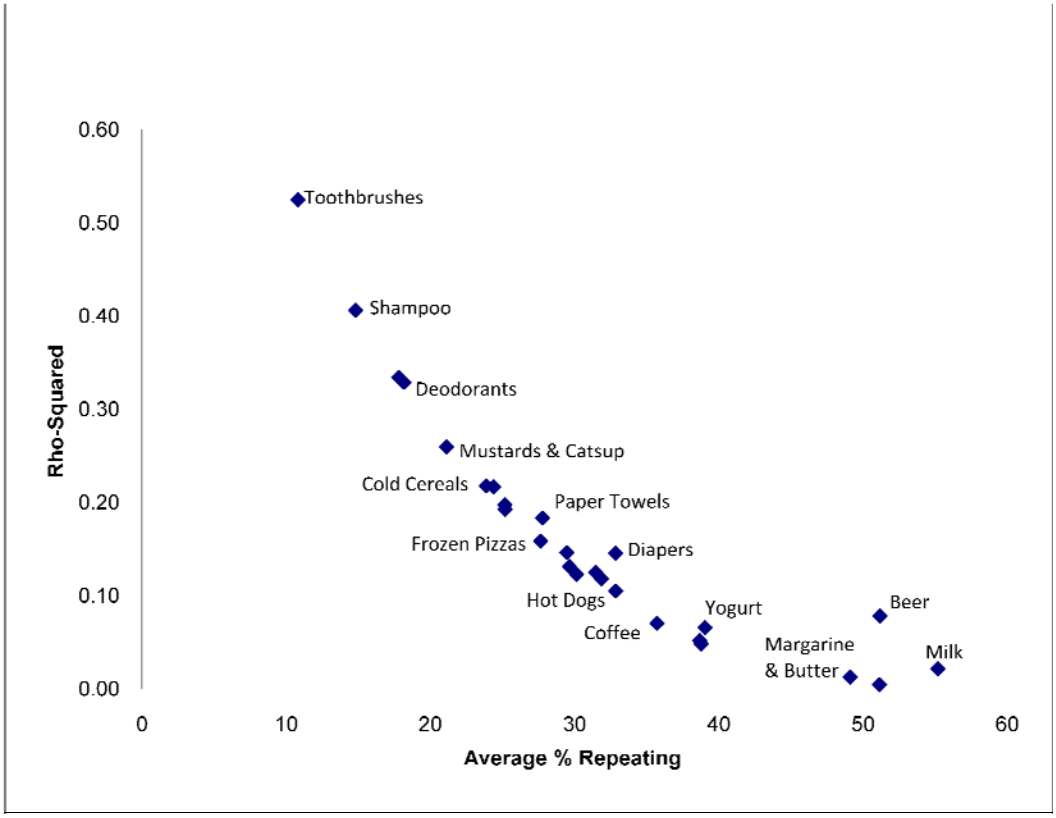
Figure 1: Percentage of sequential purchase decisions that are repetitions (choice of the same product SKU).



Data Source: see Bronnenberg et al. (2008)

Figure 2: The Power of Socio-Demographics to Explain Repeated SKU Purchasing



Data Source: see Bronnenberg et al. (2008)

Figure 3: Decision Strategy and Product Choice Selection

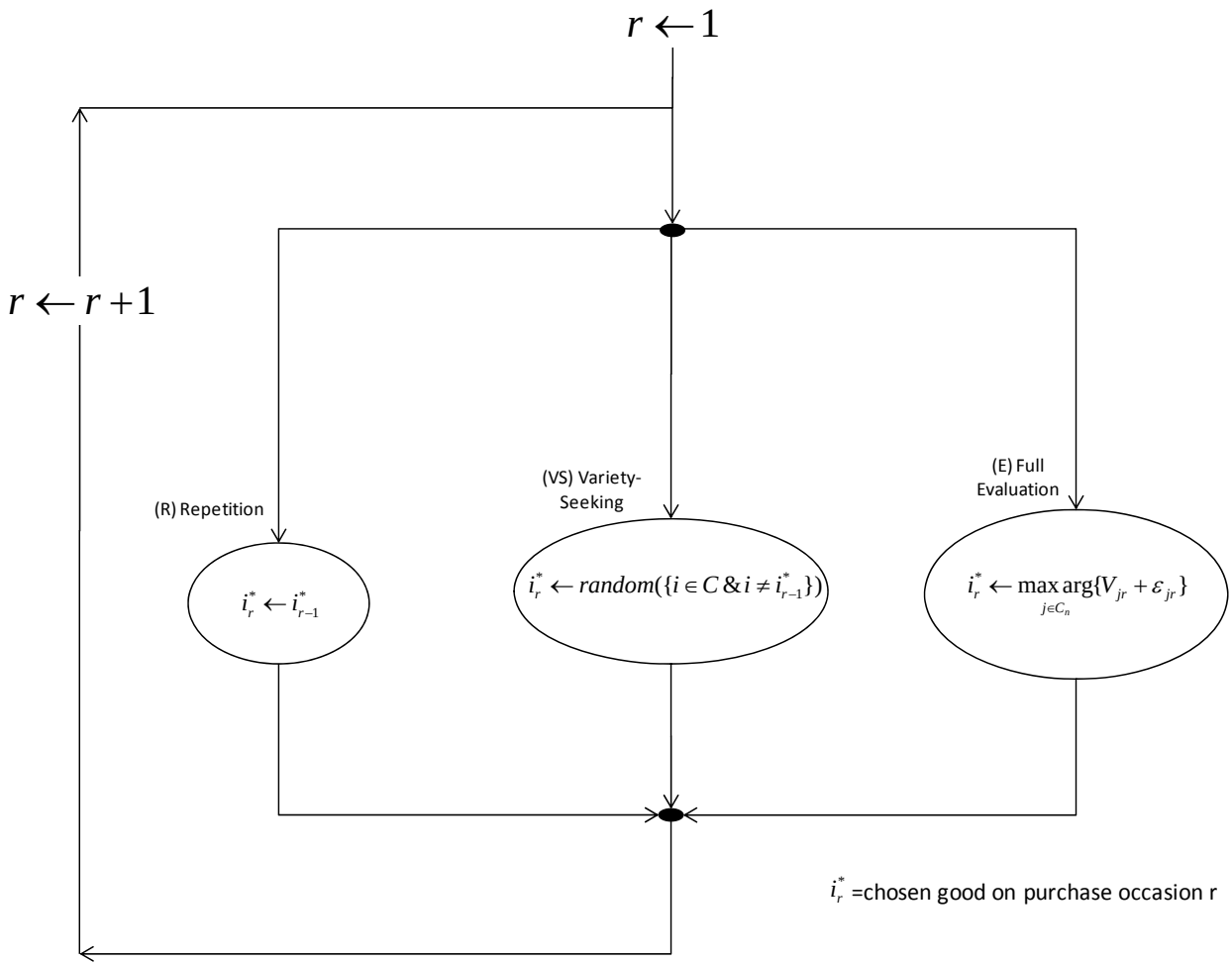


Figure 4: Decision Mode Selection Probabilities As a Function of Interpurchase Time and In-Store Promotions – Catsup Category

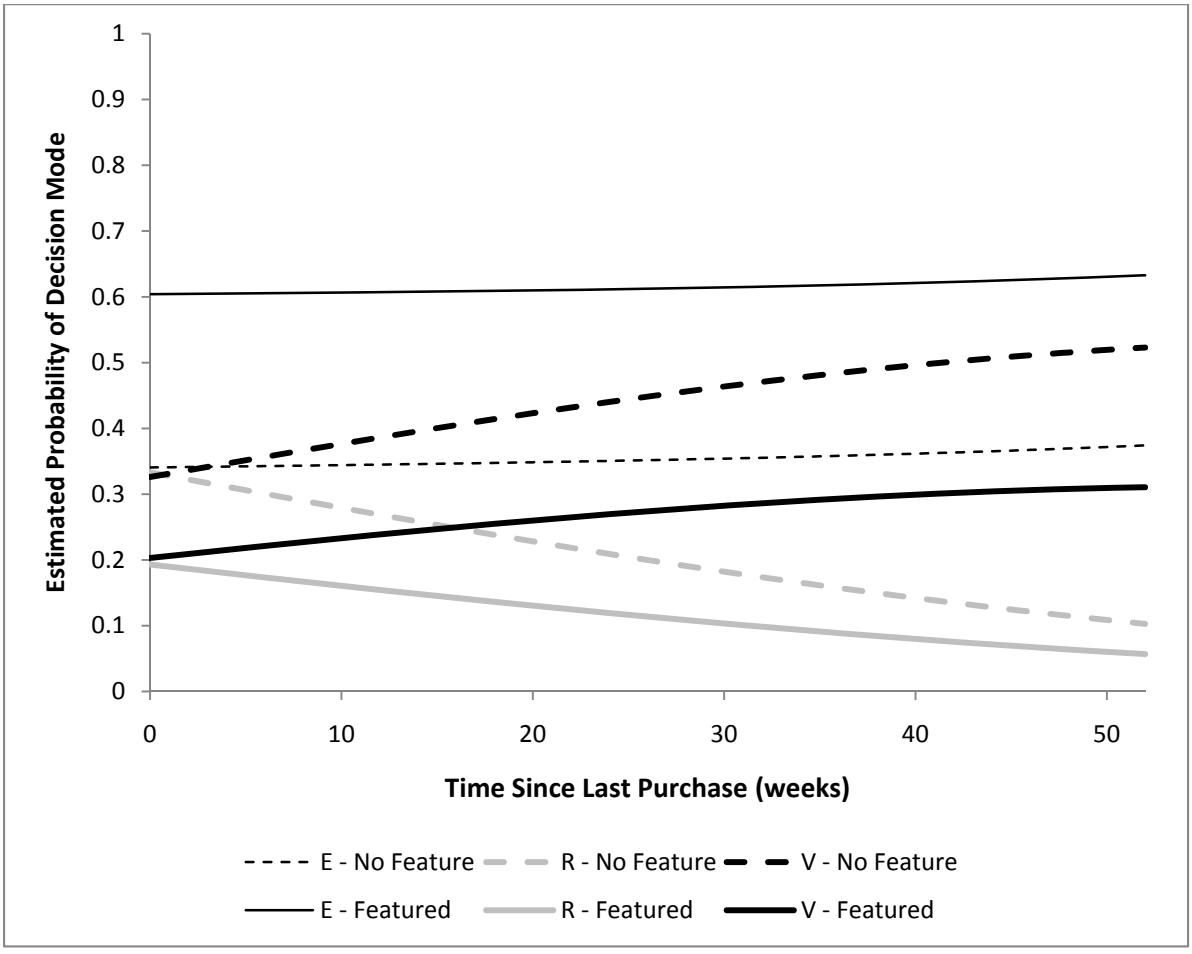


Figure 5: Decision Mode Selection Probabilities As a Function of Interpurchase Time and In-Store Promotions – Yogurt Category

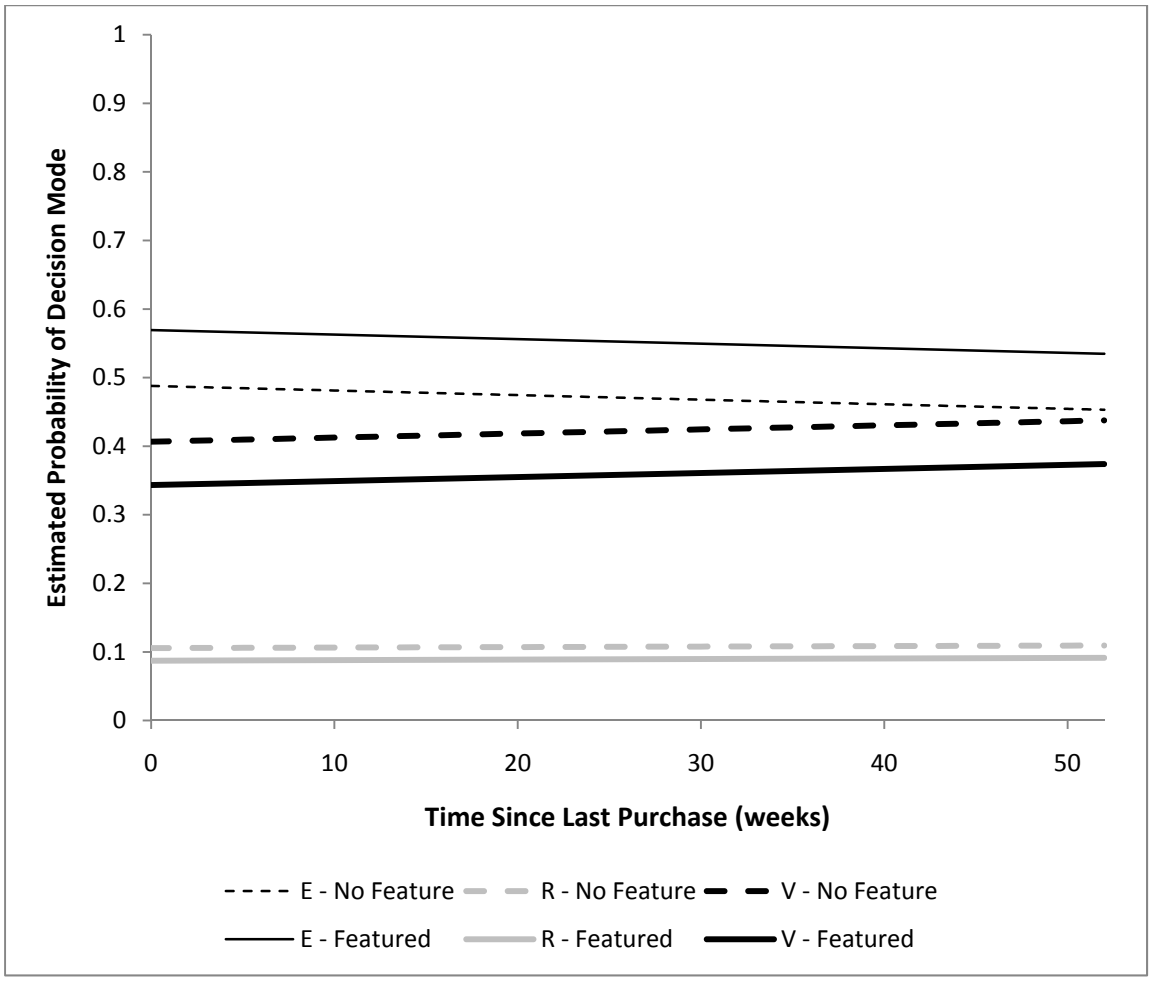


Figure 6: Decision Mode Selection Probabilities For a Specific Household – Catsup Category

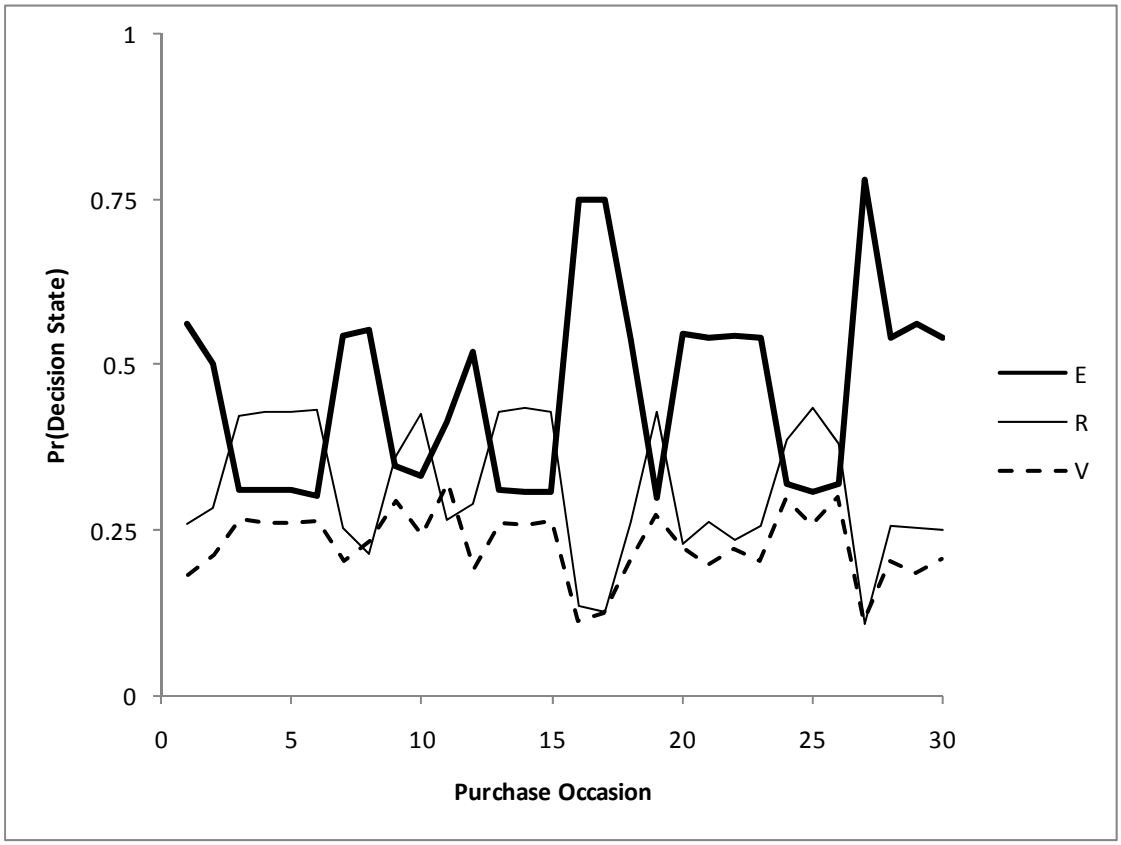


Figure 7: Decision Mode Selection Probabilities For a Specific Household – Yogurt Category

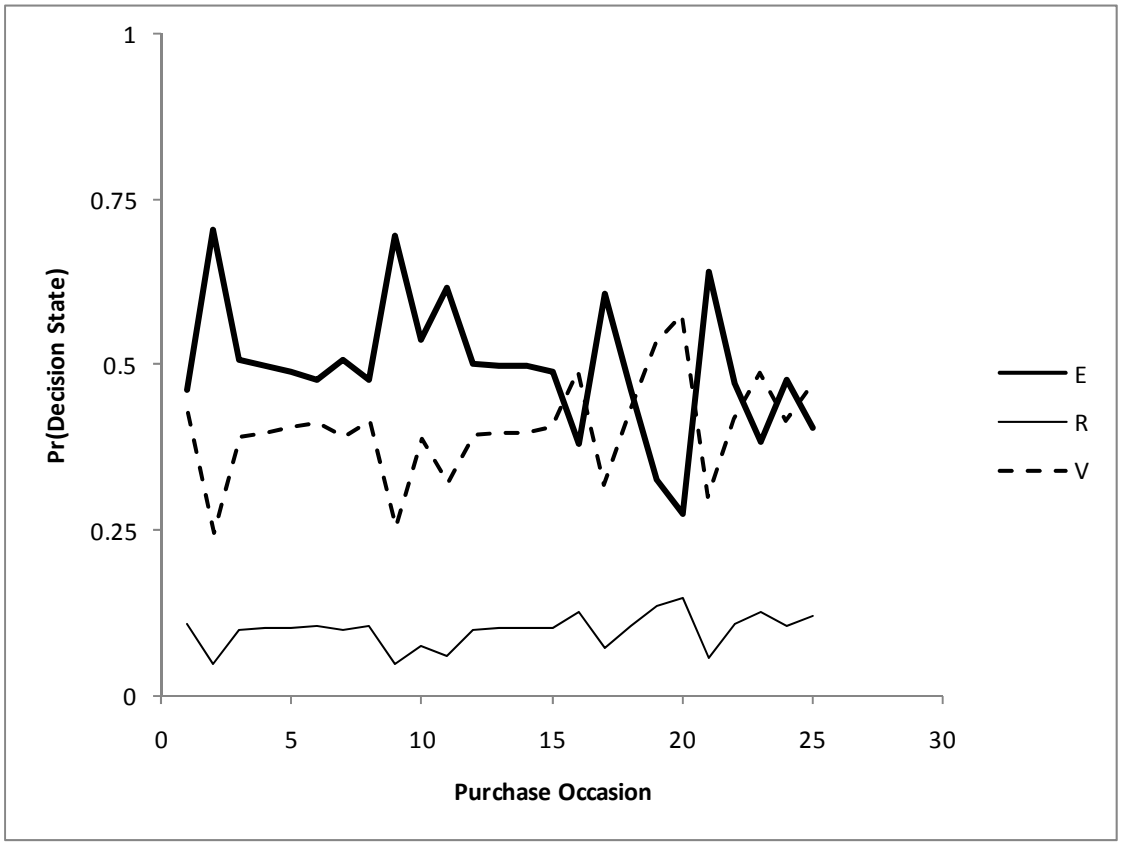


Table 1 – Decision Mode and Product SKU Selection Models

(asymptotic t-stats)	Catsup	Yogurt
Evaluative Mode - SKU Utility Function		
Brand 1	-0.4828 (-1.09)	-0.3112 (-0.14)
Brand 2	-0.4704 (-1.06)	-0.3873 (-0.17)
Brand 3	-0.6264 (-1.41)	0.3471 (3.86)
Brand 4	-0-	-0.0803 (-0.57)
Brand 5		-0.3622 (-0.16)
Brand 6		-0.0675 (-0.71)
Brand 7		-0-
Attribute 1	1.5903 (3.61)	-0.3838 (-0.17)
Attribute 2	0.0048 (0.16)	-0.6976 (-4.36)
Attribute 3		-0.6140 (-0.28)
Attribute 4		0.6769 (1.76)
Attribute 5		0.6783 (1.79)
Attribute 6		0.2890 (0.78)
Attribute 7		0.6160 (1.62)
Attribute 8		0.0415 (0.1)
Size (oz)	-0.7380 (-3.33)	-0.4754 (-1.55)
Size^2	-7.6413 (-12.38)	-1.2609 (-2.09)
SKU Price ($)	-0.0382 (-2.74)	-0.9223 (-5.07)
In-Store Display	1.1285 (23.03)	---
Weekly Insert	1.118 (23.61)	1.2481 (5.52)

(Continued)

Table 1 – (Continued)

(asymptotic t-stats)	Catsup			Yogurt		
Decision Mode	Evaluative	Pure Variety Seeking	Pure Repetition	Evaluative	Pure Variety Seeking	Pure Repetition
Utility Scale - $(\mu_E)^{1/2}$	4.1735 (5.80)	––	––	1.6607 (10.43)	––	––
Propensity Function						
Constant	-1.4842 (-16.21)	-0.5547 (-10.34)	-0-	0.8190 (1.93)	1.3484 (13.75)	-0-
$ln \sum_{j \in C_n} e^{V_j}$	1.0	-0-	-0-	1.0	-0-	-0-
T=Interpurchase Time (weeks)/100	1.7327 (4.32)	3.2086 (7.70)	-0-	-0.2082 (-0.13)	0.0754 (0.05)	-0-
T^2	1.3623 (2.18)	-0.0761 (-0.12)	-0-	-0.0628 (-0.02)	0.1558 (0.06)	-0-
Number of SKUs on Display		0.2666 (5.48)	-0-		––	-0-
Number of SKUs Featured		0.0709 (1.56)	-0-		0.0219 (1.11)	-0-
Goodness-of-fit						
LL(0)		-54105.61			-16335.23	
LL(Convergence)		-36814.06			-15069.92	
Number of Parameters		19			26	
Rho-Sq		0.3196			0.0775	
Rho-Sq Bar		0.3192			0.0759	
Number of Choices		17504			3885	
Number of Alternatives		22			67	

Table 2 – MNL Choice Models with Lagged Choice Variable

(asymptotic t-stats)	Catsup	Yogurt
SKU Utility Function		
Brand 1	-0.4304 (-1.50)	-0.2332 (-0.60)
Brand 2	0.0083 (0.00)	0.0098 (0.00)
Brand 3	-1.1767 (-3.90)	0.4044 (4.00)
Brand 4	-0-	-0.2684 (-1.20)
Brand 5		-0.4507 (-1.00)
Brand 6		-0.3586 (-2.40)
Brand 7		-0-
Attribute 1	2.3993 (11.60)	-1.1552 (-2.80)
Attribute 2	1.4368 (4.90)	-1.4025 (-7.70)
Attribute 3		-1.8976 (-4.90)
Attribute 4		1.4541 (5.00)
Attribute 5		1.2849 (4.70)
Attribute 6		0.5199 (1.90)
Attribute 7		1.1479 (4.10)
Attribute 8		0.6238 (2.10)
Size (oz)	0.6506 (7.00)	-0.0306 (-0.20)
Size^2	-1.8184 (-12.20)	-0.6500(-2.40)
SKU Price ($)	-0.3655 (-20.60)	-0.1231 (-2.60)
Display	2.6584 (73.70)	---
Feature	2.6491 (76.60)	2.2964 (31.90)
LastSKU	2.3958 (121.70)	1.8610 (33.50)
Goodness-of-fit		
LL(0)	-54105.61	-16335.23
LL(Convergence)	-37903.50	-15218.50
Number Params.	15	19
Rho-Sq	0.2995	0.0684
Rho-Sq Bar	0.2992	0.0672
Number Obs. Choices	17504	3885
Number Alternatives	22	67

Endnotes

[i] These data are available for purchase from Information Resources Inc., as detailed in Bronnenberg et al. (2008). Its use is limited to academic research.

[ii] Details about the individual logistic regression models are available from the authors upon request.